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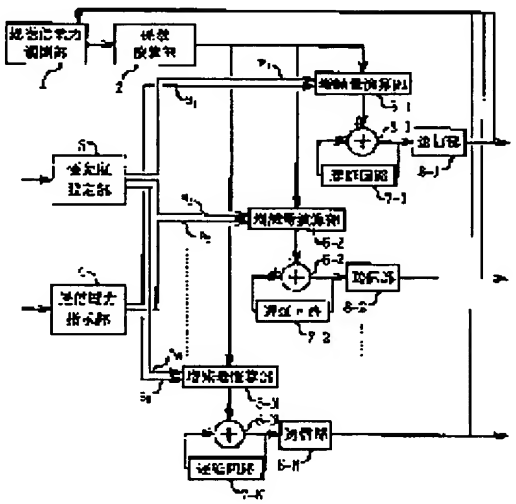
(54) TRANSMISSION POWER CONTROLLER

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a transmission power controller that controls transmission power of transmission signals so as to reduce interference between the transmission signals sent to a plurality of mobile stations.
SOLUTION: The transmission power controller consists of a total transmission power observation section 1 that observes a total sum of power of transmission signals to provide an output of a value of total transmission power, a coefficient arithmetic section 2 that calculates a coefficient a in response to the value of total transmission power, a priority setting section 3 that calculates a weight coefficient wk depending on priority of a mobile station, and a plurality of transmission power arithmetic sections that use the coefficient a, a control signal, the weight coefficient wk, an increased/decreased amount arithmetic section 5-k, an adder 6-k, and a delay circuit 7-k (k=1-N) to calculate a new transmission power value of a corresponding mobile station MSk and to provide respective outputs.



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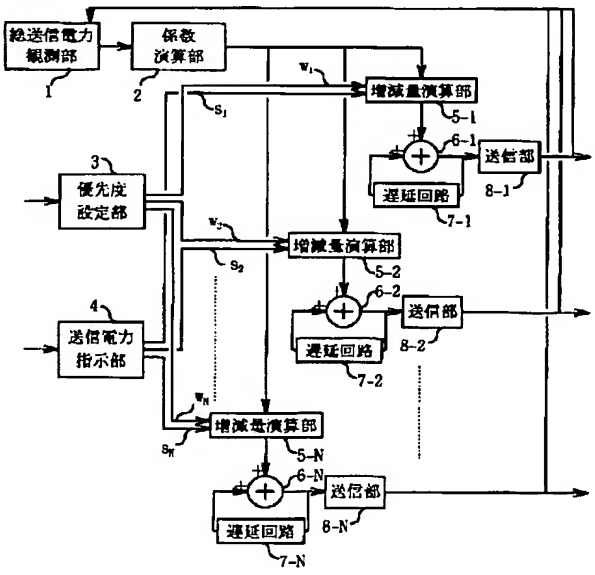
(54)【発明の名称】　送信電力制御装置

(57)【要約】
【目的】　複数の移動局への送信信号の間の干渉が少なくなるように、前記送信信号の送信電力を制御する送信電力制御装置を提供する。
【構成】　前記送信信号の電力の総和を観測して総送信電力値を出力する総送信電力観測部１と、総送信電力値に応じた係数αを算出する係数演算部２と、移動局の優先度に応じた重み係数w_kを算出する優先度設定部３と、係数αと制御信号と重み係数w_kと増減量演算部５－ｋと加算器６－ｋと遅延回路７－ｋとを用いて、対応する移動局MS_kの新たな送信電力値を計算してそれぞれ出力する複数の送信電力演算部とで構成される。



本発明の送信電力制御装置のブロック図

【特許請求の範囲】
【請求項１】　基地局から複数の移動局への送信信号の電力を、前記各移動局からの制御信号に応じて前記各移動局毎に制御する送信電力制御装置において、
前記送信信号の電力の総和を観測して総送信電力値を出力する総送信電力観測部と、
前記総送信電力値に応じた係数αを算出する係数演算部と、
前記係数αと前記制御信号とを用いて対応する移動局の新たな送信電力値を算出し新送信電力値としてそれぞれ出力する複数の送信電力演算部とを備え、
前記複数の送信電力演算部は、それぞれ、
前記制御信号が電力の減少を示す場合は、送信電力の増減量の基準となる正数に－１を乗算して乗算結果を出力し、前記制御信号が電力の増加を示す場合は、対応する移動局の優先度に従って定められた優先係数と前記係数αと前記正数との積を前記正数から減算して減算結果を出力する増減量演算部と、
所定時間前の送信電力値と前記増減量演算部の出力とを加算して加算結果を前記新送信電力値として出力する加算器と、
前記新送信電力値を前記所定時間だけ遅延させて前記加算器に出力する遅延回路とを備え、
前記優先係数は、０より大きく１より小さい値で、対応する移動局の通信がより重要であるほどより０に近い値であることを特徴とする送信電力制御装置。
【請求項２】　請求項１に記載の送信電力制御装置において、
前記係数演算部は、
前記総送信電力値が所定値以下である場合は、前記係数αを０とし、
前記総送信電力値が前記所定値より大きく、かつ、可能な総送信電力値の最大値より小さい場合は、前記係数αを０より大きく１より小さい値とし、かつ、前記総送信電力値がより大きいほど前記係数αを１により近い値とし、
前記総送信電力値が前記最大値以上である場合は、前記係数αを１とすることを特徴とする送信電力制御装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、送信電力制御装置に関し、特に、スペクトル拡散通信方式を用いる移動通信システムにおける下りリンク送信電力制御装置に関する。
【０００２】
【従来の技術】現在、無線伝送路をシェアリングして複数ユーザによる同時通信を可能とするマルチプルアクセス（多元接続）方式として、符号分割マルチプルアクセス（Ｃｏｄｅ　Ｄｉｖｉｓｉｏｎ　Ｍｕｌｔｉｐｌｅ　Ａｃｃｅｓｓ：以下、ＣＤＭＡという）方式が注目されている。ＣＤＭＡ方式は、スペクトル拡散技術を使用して、同一周波数帯を複数のユーザに割り当てる方式である。ＣＤＭＡ方式において加入者容量を増加させるためには、高精度の送信電力制御が必須とされる。
【０００３】ＣＤＭＡ方式における、従来の下りリンク送信電力制御方法は次のとおりである。移動局内部には、受信信号に要求される受信信号対干渉波電力比（Ｓｉｇｎａｌ－Ｉｎｔｅｒｆｅｒｅｎｃｅ　Ｐｏｗｅｒ　Ｒａｔｉｏ：以下、ＳＩＲという）が目標ＳＩＲとして予め設定されている。ＳＩＲが小さい値ということは、自己の信号の干渉波電力に対する比率が小さいことを意味し、ＳＩＲが大きい値ということは、自己の信号の干渉波電力に対する比率が大きいことを意味する。
【０００４】移動局は受信信号のＳＩＲを観測し、観測されたＳＩＲと目標ＳＩＲを比較する。観測されたＳＩＲが目標ＳＩＲより小さい場合、移動局は送信電力の増大を指示する送信電力制御命令を基地局に送信する。観測されたＳＩＲが目標ＳＩＲより大きい場合、移動局は送信電力の減少を指示する送信電力制御命令を基地局に送信する。基地局は、この送信電力制御命令に従って、対応する移動局への送信信号の送信電力を調整する。
【０００５】
【発明が解決しようとする課題】上記の従来の技術には、以下の問題がある。
【０００６】１つの基地局に対する移動局の数が増加すると、各移動局の受信信号のＳＩＲは低下する。各移動局は、観測された受信信号のＳＩＲが低下すると、各移動局の目標ＳＩＲに基づいて送信電力の増大を指示する送信電力制御命令を基地局に送信する。基地局は、各移動局の送信信号の送信電力を増大する。各移動局にとって、他の移動局への送信信号の送信電力の増大は、さらなるＳＩＲの低下の原因となり得る。受信信号のＳＩＲが低下した移動局は、各移動局の目標ＳＩＲに基づいて送信電力の増大を指示する送信電力制御命令を基地局に送信する。この悪循環が繰り返されると、送信電力が増大されたにもかかわらず、通信品質が劣化する、という問題が起こる。
【０００７】そこで本発明は、上記の問題を解決した送信電力制御装置を提供することを目的とする。
【０００８】
【課題を解決するための手段】本発明では、上記目的を達成する送信電力制御装置として、基地局から複数の移動局への送信信号の電力を、前記各移動局からの制御信号に応じて前記各移動局毎に制御する送信電力制御装置において、前記送信信号の電力の総和を観測して総送信電力値を出力する総送信電力観測部と、前記総送信電力値に応じた係数αを算出する係数演算部と、前記係数αと前記制御信号とを用いて対応する移動局の新たな送信電力値を算出し新送信電力値としてそれぞれ出力する複数の送信電力演算部とを備え、前記複数の送信電力演算

部は、それぞれ、　前記制御信号が電力の減少を示す場合は、送信電力の増減量の基準となる正数に－１を乗算して乗算結果を出力し、前記制御信号が電力の増加を示す場合は、対応する移動局の優先度に従って定められた優先係数と前記係数αと前記正数との積を前記正数から減算して減算結果を出力する増減量演算部と、所定時間前の送信電力値と前記増減量演算部の出力とを加算して加算結果を前記新送信電力値として出力する加算器と、前記新送信電力値を前記所定時間だけ遅延させて前記加算器に出力する遅延回路とを備え、前記優先係数は、０より大きく１より小さい値で、対応する移動局の通信がより重要であるほどより０に近い値であることを特徴とする送信電力制御装置を提供する。

【０００９】

【発明の実施の形態】本発明の送信電力制御装置について説明する。説明中、本発明の送信電力制御装置を備える基地局を基地局Ａと表す。

【００１０】図１は、本発明の送信電力制御装置のブロック図である。

【００１１】図１の送信電力制御装置の構成を説明する。

【００１２】送信電力制御装置は、総送信電力観測部１、係数演算部２、優先度設定部３、送信電力指示部４、増減量演算部５－１～５－Ｎ、加算器６－１～６－Ｎ、遅延回路７－１～７－Ｎ、及び、送信部８－１～８－Ｎを備える。Ｎは、基地局Ａが同時接続している移動局の数である。増減量演算部５－ｋ、加算器６－ｋ、遅延回路７－ｋ及び送信部８－ｋ（ｋ＝１～Ｎ）は、対応する移動局MS_kへの送信に用いられる送信電力の制御に用いられる。

【００１３】総送信電力観測部１は、基地局Ａの無線エリア内にある、全ての移動局への送信電力の総和を観測し観測値Ｐａを出力する部分である。係数演算部２は観測値Ｐａに応じて送信電力の増減量の演算に用いる係数αを算出する部分である。優先度設定部３は各移動局の優先度に対応する重み係数w_iを決定し出力する部分である。重み係数w_1～w_Nは、０より大きく１より小さい値である。重み係数w_1～w_Nは、それぞれ対応する移動局MS_1～MS_kの優先度が高いほど０に近く、優先度が低いほど１に近い値である。送信電力指示部４は、各移動局から転送されてくる各送信電力制御命令を対応する増減量演算部５－１～５－Ｎへ要求符号s_1～s_Nとして出力する部分である。要求符号s_kは、それが正の値である場合は送信電力増加要求を示し、それが負の値である場合は送信電力減少要求を示す。各送信電力制御命令は各移動局の必要に応じて送信されるため、各送信電力制御命令全てが同時に基地局Ａに到達するわけではない。

【００１４】増減量演算部５－１～５－Ｎは、新たに要求符号s_1～s_Nが入力された場合にのみ、優先度設定部３の出力である重み係数w_1～w_Nと定数δと係数演算部２の出力である係数αと送信電力指示部４の出力である要求符号s_1～s_Nとを用いて、各移動局への送信電力の増減量を計算する回路である。増減量演算部５－１～５－Ｎは、新たに要求符号s_1～s_Nが入力されなかった場合は、０を出力する。定数δは基準となる増減量である。

【００１５】遅延回路７－１～７－Ｎは、入力値を１測定周期Ｔ遅延して出力する回路である。加算器６－１～６－Ｎはそれぞれ増減量演算部５－１～５－Ｎの出力と遅延回路７－１～７－Ｎの出力とを加算して送信電力値p_1～p_Nとして出力する部分である。送信部８－１～８－Ｎは、各移動局MS_1～MS_kへ信号を送信する際、その送信電力を対応する送信電力値p_1～p_Nに従って調整する。

【００１６】図１に示す送信電力制御装置の動作を説明する。

【００１７】総送信電力観測部１は、基地局Ａの無線エリア内にある全ての移動局への総送信電力を観測する。総送信電力観測部１は、送信部８－１～８－Ｎから出力される信号の測定周期Ｔの間の総送信電力を測定し、その平均値を測定周期Ｔ毎に観測値Ｐａとして出力する。観測値Ｐａは係数演算部２に入力される。

【００１８】係数演算部２は、観測値Ｐａに対応する係数αを算出する。算出方法の例として、図２のグラフに従って係数αを算出する方法と、図３のグラフに従って係数αを算出する方法とを挙げる。図２のグラフに従う方法では、観測値Ｐａの範囲に対応して非連続的に係数αが決められる。例えば、観測値Ｐａが値Ｔｈ２より大きく、かつ、値Ｔｈ３より小さい場合は、α２が係数αとして出力される。図３のグラフに従う方法では、観測値Ｐａに対応して連続的に係数αが決められる。いずれの場合も、観測値Ｐａが、基地局と移動局との間の通信に適用され得る最大総送信電力値Ｐｍａｘより大きい場合、係数αは１となる。係数αは、各移動局に対応する増減量演算部５－１～５－Ｎに入力される。

【００１９】優先度設定部３は、重み係数w_kを設定して出力する。設定方法の例として、基地局Ａが各移動局に対する優先度を決定しその優先度に対応する重み係数w_kを決める方法と、各移動局が要求したい優先度を基地局Ａに送信し基地局Ａがその優先度に応じて重み係数w_kを決める方法とを挙げる。

【００２０】基地局Ａが移動局MS_kに対する優先度を決定しその優先度に対応する重み係数w_kを決める方法について説明する。

【００２１】優先度設定部３は、内部に予め、各移動局MS_1～MS_Nと各移動局MS_1～MS_Nの契約内容に応じた重み係数w_1～w_kとの対応表をもっている。対応表は各移動局が基地局Ａのエリアに出入りするたびに書きかえられる。移動局MS_kは基地局Ａのエリア内に入った

ときに、基地局Ａからのパイロットチャネルの検出およびシステムチャネルの検出によってシステム同期を確立する。この後、移動局MS_kは基地局Ａにレジストレーション（利用者情報・端末情報）を送信する。基地局Ａは移動局MS_kから受信した端末情報を制御局に送信する。制御局は受信した端末情報からその端末利用者が加入しているサービス内容を検出して基地局Ａに送信する。基地局Ａは、優先度設定部３内部の対応表に、そのサービス内容に応じて移動局MS_kに対応する重み係数w_kを設定する。例えば、移動局MS_kが品質を重視するサービス契約をしている場合、優先度設定部３内部の対応表では、移動局MS_kに対応する重み係数w_kとして０．３が設定される。

【００２２】この重み係数の設定は各移動局の着信時および発信時に行われる。着信時には、まず、基地局Ａが移動局MS_kの呼び出し信号をエリアに放射する。移動局MS_kが応答メッセージを基地局Ａに送信する。基地局Ａが応答メッセージを受信した時点で、優先度設定部３は移動局MS_kの重み係数w_kを増減量演算部５－ｋへ出力する。発信時には、まず、移動局MS_kが通話要求信号を基地局Ａへ出力する。基地局Ａが通話要求信号を受信した時点で優先度設定部３は移動局MS_kの重み係数w_kを増減量演算部５－ｋへ出力する。

【００２３】各移動局が要求したい優先度を基地局Ａに送信し基地局Ａがその優先度に応じて重み係数w_kを決める方法について説明する。

【００２４】応答メッセージには優先度を表すフラグが挿入されている。優先度は１～１０までの１０個の数字を使って表され、数が多いほうがより重要である。基地局Ａは応答メッセージ中の優先度を表すフラグから優先度を取りだして優先度設定部３に送る。優先度設定部３は優先度の逆数を計算し重み係数w_kとして増減量演算部５－ｋへ出力する。

【００２５】各増減量演算部５－１～５－Ｎには、送信電力指示部４から要求符号s_1～s_Nも入力される。増減量演算部５－ｋ（ｋ＝１～Ｎ）は、新たに要求符号s_kが入力された場合、次式を使って、移動局MS_kに対する送信電力の増減量Δp_kを計算する。

【００２６】

【数１】

$s_k > 0$の場合　$\Delta p_k = \delta - w_k \cdot \alpha \cdot \delta$

$s_k < 0$の場合　$\Delta p_k = -\delta$

増減量演算部５－ｋ（ｋ＝１～Ｎ）は、新たに要求符号s_kが入力されなかった場合、増減量Δp_kとして０を出力する。

【００２７】加算器６－ｋは、増減量Δp_kと遅延回路７－ｋから出力された１測定周期Ｔ前の送信電力値p_kとを加算して加算結果を出力する。加算結果は、移動局MS_kに対する新たな送信電力値p_kとして送信部８－ｋに入力される。また、加算結果は遅延回路７－ｋにも入力され、測定周期Ｔ後の送信電力値p_kの計算に用いられる。送信部８－ｋは、移動局MS_kへの送信信号の送信電力を送信電力値p_kに設定する。

【００２８】本発明によれば、基地局Ａから全ての移動局への送信電力の総和が大きい場合は、その送信電力の総和が減少するように、増減量Δp_kが更新される。また、増減量Δp_kを、より優先度の高い移動局に対してはより大きく設定している。すなわち、優先度の低い移動局への送信電力を下げることで、優先度の高い移動局の送受信品質が保持しつつ、総送信電力が必要以上に大きくなるのを防ぐ。

【００２９】

【発明の効果】以上のように本発明の送信電力制御装置について、以下の効果が得られる。

【００３０】基地局の総送信電力が所定値よりも大きくなった時、その差の大きさに応じて移動局への送信信号の送信電力を更新することができる。その結果、移動局数が増大して干渉電力が大きくなったときでも、全ての移動局の通信品質が一律に劣化するのを防ぐことができる。さらに、際限なく送信電力が増加するのを防ぐことができるため、隣接基地局の無線サービスエリアに与える干渉電力の影響を抑制できる。

【００３１】さらに、移動局の優先度に応じた送信電力の更新を行うことができるため、基地局の総送信電力を目標総送信電力以下に保ちつつ、重要な通信の品質劣化を防ぐことができる。また、移動体通信の契約者に品質の優劣を使った新しいサービスなどを付加することができる。

【図面の簡単な説明】

【図１】本発明の送信電力制御装置のブロック図である。

【図２】観測値Ｐａと係数αとの第1の関係図である。

【図３】観測値Ｐａと係数αとの第２の関係図である。

【符号の説明】

１　…　総送信電力観測部

２　…　係数演算部

３　…　優先度設定部

４　…　送信電力指示部

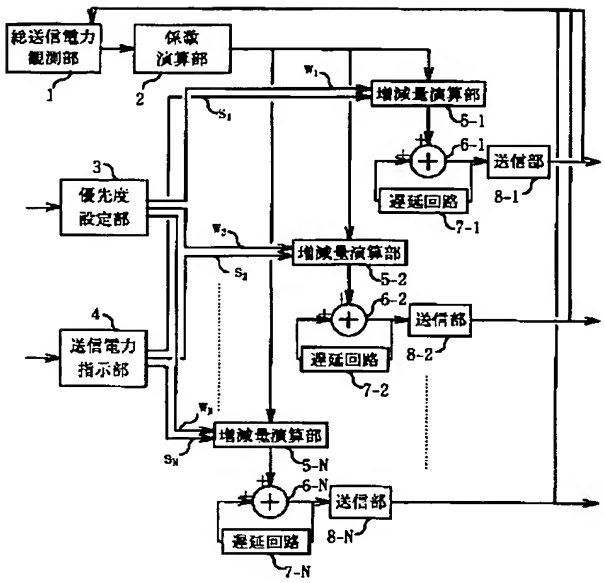
５－１～５－Ｎ　…　増減量演算部

６－１～６－Ｎ　…　加算器

７－１～７－Ｎ　…　遅延回路

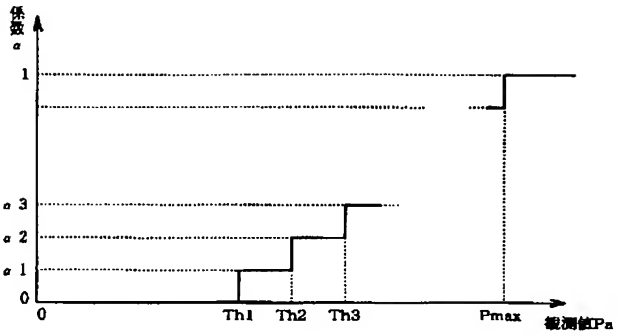
８－１～８－Ｎ　…　送信部

【図1】

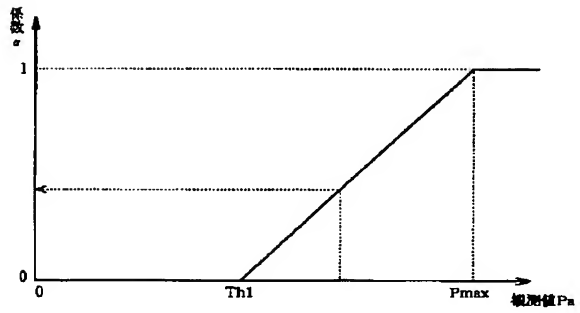


本発明の送信電力制御装置のブロック図

【図2】



【図3】



PATENT ABSTRACTS OF JAPAN

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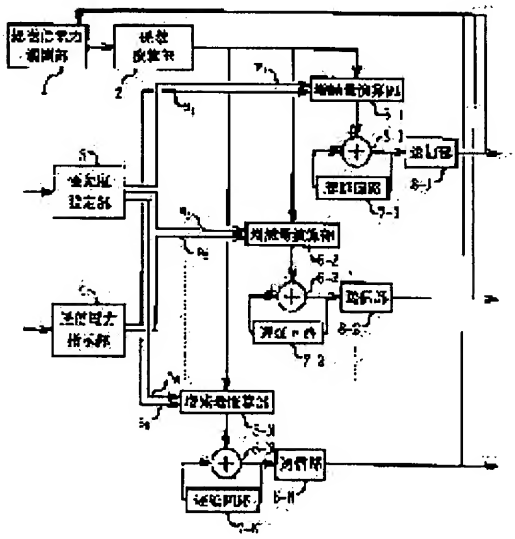
(71)Applicant : OKI ELECTRIC IND CO LTD

(72)Inventor : NISHINO MASAHIRO

(54) TRANSMISSION POWER CONTROLLER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a transmission power controller that controls transmission power of transmission signals so as to reduce interference between the transmission signals sent to a plurality of mobile stations.



SOLUTION: The transmission power controller consists of a total transmission power observation section 1 that observes a total sum of power of transmission signals to provide an output of a value of total transmission power, a coefficient arithmetic section 2 that calculates a coefficient α in response to the value of total transmission power, a priority setting section 3 that calculates a weight coefficient wk depending on priority of a mobile station, and a plurality of transmission power arithmetic sections that use the coefficient α, a control signal, the weight coefficient wk, an increased/decreased amount arithmetic section 5-k, an adder 6-k, and a delay circuit 7-k (k=1-N) to calculate a new transmission power value of a corresponding mobile station MSk and to provide respective outputs.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of

rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]
[Claim 1] In the transmitted power control unit which controls the power of the sending signal from a base station to two or more mobile stations for said every mobile station according to the control signal from said each mobile station With the total transmitted power Observations Department which observes total of the power of said sending signal and outputs the total transmitted power value It has two or more transmitted power operation part which computes the new transmitted power value of the mobile station which corresponds using the multiplier operation part which computes the multiplier alpha according to said total transmitted power value, and said multiplier alpha and said control signal, and is outputted as a new transmitted power value, respectively. When said control signal shows reduction in power, said two or more transmitted power operation part, respectively When the multiplication of -1 is carried out to the positive number used as the criteria of the amount of increase and decrease of transmitted power, a multiplication result is outputted and said control signal shows the increment in power The amount operation part of increase and decrease which subtracts the product of the priority multiplier defined according to the priority of a corresponding mobile station, and said multiplier alpha and said positive number from said positive number, and outputs a subtraction result, The adder which adds the transmitted power value in front of predetermined time, and the output of said amount operation part of increase and decrease, and outputs an addition result as said new transmitted power value, It is the transmitted power control unit which is equipped with the delay circuit which only said predetermined time delays said new transmitted power value, and outputs it to said adder, and is characterized by being a larger value smaller than 1 than 0, and being a value more near 0, so that the communication link of a corresponding mobile station is more important for said priority multiplier.
[Claim 2] In a transmitted power control unit according to claim 1 said multiplier operation part When said total transmitted power value is below a predetermined value Said multiplier alpha is set to 0. When said total transmitted power value is smaller than the maximum of the possible total larger and transmitted power value than said predetermined value It is the transmitted power control unit which said multiplier alpha is made into a larger value smaller than 1 than 0, and makes said multiplier alpha a near value by 1, so that said total transmitted power value is more large, and is characterized by setting said multiplier alpha to 1 when said total transmitted power value is said more than maximum.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the going-down link transmitted power control unit in the migration communication system using a spread-spectrum communication mode about a transmitted power control unit.
[0002]
[Description of the Prior Art] The sign division multiple access (it is called CDMA below Code Division Multiple Access:) method attracts attention as a multiple access (point-to-multipoint connection) method which carries out the share ring of current and the radio-transmission way, and makes the broadcast by the multiple user possible. A CDMA method is a method which uses a spread-spectrum technique and assigns two or more users the same frequency band. In order to make subscriber capacity increase in a CDMA method, highly precise transmitted power control is made indispensable.
[0003] The former in a CDMA method gets down and the link transmitted power control approach is as follows. The input-signal pair interference wave power ratio (it is called SIR below Signal-Interference Power Ratio:) required of an input signal is beforehand set to the interior of a mobile station as a target SIR. The value with small SIR means that the ratio to the interference wave power of a self signal is small, and the value with large SIR means that the ratio to the interference wave power of a self signal is large.
[0004] A mobile station observes SIR of an input signal and compares SIR and Target SIR which were observed. When observed SIR is smaller than Target SIR, a mobile station transmits the transmitted power control instruction which directs increase of transmitted power to a base station. When observed SIR is larger than Target SIR, a mobile station transmits the transmitted power control instruction which directs reduction of transmitted power to a base station. A base station adjusts the transmitted power of the sending signal to a corresponding mobile station according to this transmitted power control instruction.
[0005]
[Problem(s) to be Solved by the Invention] There are the following problems in the above-mentioned Prior art.
[0006] An increment of the number of the mobile stations to one base station reduces SIR of the input signal of each mobile station. Each mobile station will transmit the transmitted power control instruction which directs increase of transmitted power based on the target SIR of each mobile station to a base station, if SIR of the observed input signal falls. A base station increases the transmitted power of the sending signal of each mobile station. For each mobile station, increase of the transmitted power of the sending signal to other mobile stations can cause [further / of SIR] a fall. The mobile station with which SIR of an input signal fell transmits the transmitted power control instruction which directs increase of transmitted power based on the target SIR of each mobile station to a base station. Although transmitted power increased when this vicious circle was repeated, the problem that communication link quality deteriorates arises.

[0007] Then, this invention aims at offering the transmitted power control unit which solved the above-mentioned problem.
[0008]
[Means for Solving the Problem] In the transmitted power control unit which controls the power of the sending signal from a base station to two or more mobile stations by this invention for said every mobile station as a transmitted power control unit which attains the above-mentioned purpose according to the control signal from said each mobile station With the total transmitted power Observations Department which observes total of the power of said sending signal and outputs the total transmitted power value It has two or more transmitted power operation part which computes the new transmitted power value of the mobile station which corresponds using the multiplier operation part which computes the multiplier alpha according to said total transmitted power value, and said multiplier alpha and said control signal, and is outputted as a new transmitted power value, respectively. Said two or more transmitted power operation part is each. When said control signal shows reduction in power When the multiplication of -1 is carried out to the positive number used as the criteria of the amount of increase and decrease of transmitted power, a multiplication result is outputted and said control signal shows the increment in power The amount operation part of increase and decrease which subtracts the product of the priority multiplier defined according to the priority of a corresponding mobile station, and said multiplier alpha and said positive number from said positive number, and outputs a subtraction result, The adder which adds the transmitted power value in front of predetermined time, and the output of said amount operation part of increase and decrease, and outputs an addition result as said new transmitted power value, It has the delay circuit which only said predetermined time delays said new transmitted power value, and outputs it to said adder, and it offers the transmitted power control unit characterized by being a value more near 0, so that the communication link of the mobile station which is a larger value smaller than 1 than 0, and corresponds is more important for said priority multiplier.
[0009]
[Embodiment of the Invention] The transmitted power control unit of this invention is explained. A base station equipped with the transmitted power control unit of this invention is expressed as a base station A during explanation.
[0010] Drawing 1 is the block diagram of the transmitted power control unit of this invention.
[0011] The configuration of the transmitted power control unit of drawing 1 is explained.
[0012] A transmitted power control unit is equipped with the total transmitted power Observations Department 1, the multiplier operation part 2, the priority setting section 3, the transmitted power directions section 4, the amount operation part 5-1 of increase and decrease - 5-N, an adder 6-1 - 6-N, a delay circuit 7-1 - 7-N, and the transmitting section 8-1 - 8-N. N is the number of the mobile stations which the base station A connects concurrently. Amount operation part of increase and decrease 5-k, adder 6-k, delay circuit 7-k, and transmitting section 8-k (k= 1 - N) are used for control of the transmitted power used for transmission to the corresponding mobile station MSk.
[0013] The total transmitted power Observations Department 1 is a part in the wireless area of a base station A which observes total of the transmitted power to all mobile stations, and outputs observed value Pa. The multiplier operation part 2 is a part which computes the multiplier alpha used for the operation of the amount of increase and decrease of transmitted power according to observed value Pa. The priority setting section 3 is a part which determines and outputs the weighting factor wi corresponding to the priority of each mobile station. It is a value with it. [from weighting factors w1-0] [large wN and] [smaller than 1] Weighting factors w1-wN are the values near 1, so that near and a priority are so low that the priority of the mobile stations MS1-MSk which correspond, respectively is high to 0. The transmitted power directions section 4 is a part which outputs each transmitted power control instruction transmitted from each mobile station as demand signs s1-sN to the corresponding amount operation part 5-1 of increase and decrease - 5-N. The demand sign sk shows the increment demand in transmitted power, when it is a forward value, and when it is a negative value, it shows a transmitted power reduction demand. Since each transmitted power control instruction is transmitted if needed for each mobile station, each transmitted power control instruction of all does not arrive at a base

station A at coincidence.
[0014] The amount operation part 5-1 of increase and decrease - 5-N are circuits which calculate the amount of increase and decrease of the transmitted power to each mobile station using the weighting factors w1-wN which are the outputs of the priority setting section 3, a constant delta and the multiplier alpha which is the output of the multiplier operation part 2, and the demand signs s1-sN which are the outputs of the transmitted power directions section 4, only when the demand signs s1-sN are newly inputted. The amount operation part 5-1 of increase and decrease - 5-N output 0, when the demand signs s1-sN are not newly inputted. A constant delta is the amount of increase and decrease used as criteria.
[0015] A delay circuit 7-1 - 7-N are circuits which carry out 1 measurement-cycle T delay of the input value, and output it. An adder 6-1 - 6-N are parts which add the output of the amount operation part 5-1 of increase and decrease - 5-N, and the output of a delay circuit 7-1 - 7-N, and are outputted as transmitted power values p1-pN, respectively. In case the transmitting section 8-1 - 8-N transmit a signal to each mobile stations MS1-MSk, they adjust the transmitted power according to the corresponding transmitted power values p1-pN.
[0016] Actuation of the transmitted power control unit shown in drawing 1 is explained.
[0017] The total transmitted power Observations Department 1 observes the total transmitted power to all the mobile stations in the wireless area of a base station A. The total transmitted power Observations Department 1 measures the total transmitted power between the measurement cycles T of the signal outputted from the transmitting section 8-1 - 8-N, and outputs the average as observed value Pa to every measurement cycle T. Observed value Pa is inputted into the multiplier operation part 2.
[0018] The multiplier operation part 2 computes the multiplier alpha corresponding to observed value Pa. The approach of computing a multiplier alpha as an example of the calculation approach according to the graph of drawing 2 and the approach of computing a multiplier alpha according to the graph of drawing 3 are mentioned. By the approach of following the graph of drawing 2 , a multiplier alpha is decided in discontinuous corresponding to the range of observed value Pa. For example, when observed value Pa is larger than a value Th 2 and smaller than a value Th 3, alpha 2 is outputted as a multiplier alpha. By the approach of following the graph of drawing 3 , a multiplier alpha is continuously decided corresponding to observed value Pa. A multiplier alpha is set to 1 when observed value Pa is larger than the maximum total transmitted power value Pmax which may be applied to the communication link between a base station and a mobile station in any case. A multiplier alpha is inputted into the amount operation part 5-1 of increase and decrease corresponding to each mobile station - 5-N.
[0019] The priority setting section 3 sets up and outputs a weighting factor wk. The approach of a base station A determining the priority over each mobile station as an example of the setting approach, and deciding the weighting factor wk corresponding to the priority, and how a priority to require each mobile station is transmitted to a base station A, and a base station A determines a weighting factor wk according to the priority are mentioned.
[0020] A base station A explains how to determine the priority over a mobile station MSk and to decide the weighting factor wk corresponding to the priority.
[0021] The priority setting section 3 has a conversion table with the weighting factors w1-wk according to the contents of a contract of each mobile stations MS1-MSN and each mobile stations MS1-MSN in the interior beforehand. A conversion table is rewritten whenever each mobile station frequents the area of a base station A. A mobile station MSk establishes a system synchronization by detection of the pilot channel from a base station A, and detection of a system channel, when it enters in the area of a base station A. Then, a mobile station MSk transmits registration (user information and terminal information) to a base station A. A base station A transmits the terminal information received from the mobile station MSk to a control station. A control station detects the contents of service which the terminal user has joined from the received terminal information, and transmits to a base station A. A base station A sets the weighting factor wk corresponding to a mobile station MSk as the conversion table of the priority setting section 3 interior according to the contents of service. For example, when the mobile station MSk is carrying out the service contract of thinking quality as important, in the conversion table of the priority setting section 3 interior, 0.3 is set up as a weighting factor wk corresponding to a mobile station

MSk.
[0022] A setup of this weighting factor is performed at the time of the arrival of each mobile station, and dispatch. At the time of arrival of the mail, a base station A emits ringing of a mobile station MSk to area first. A mobile station MSk transmits a response message to a base station A. When a base station A receives a response message, the priority setting section 3 outputs the weighting factor wk of a mobile station MSk to amount operation part of increase and decrease 5-k. At the time of dispatch, a mobile station MSk outputs a message demand signal to a base station A first. When a base station A receives a message demand signal, the priority setting section 3 outputs the weighting factor wk of a mobile station MSk to amount operation part of increase and decrease 5-k.
[0023] How a priority to require each mobile station is transmitted to a base station A, and a base station A determines a weighting factor wk according to the priority is explained.
[0024] The flag showing a priority is inserted in the response message. A priority is expressed using ten figures to 1-10, and the more numerous one is more important for it. A base station A takes out a priority from the flag showing the priority in a response message, and sends it to the priority setting section 3. The priority setting section 3 calculates the inverse number of a priority, and outputs it to amount operation part of increase and decrease 5-k as a weighting factor wk.
[0025] The demand signs s1-sN are also inputted into each amount operation part 5-1 of increase and decrease - 5-N from the transmitted power directions section 4. Amount operation part of increase and decrease 5-k (k= 1 - N) calculates amount of increase and decrease deltapk of transmitted power to a mobile station MSk using a degree type, when the demand sign sk is newly inputted.
[0026]
[Equation 1]
sk> In the case of 0 In the case of delta pk=delta-wk-alpha-delta sk<0 Amount operation part of deltapk=-delta increase and decrease 5-k (k= 1 - N) outputs 0 as amount of increase and decrease deltapk, when the demand sign sk is not newly inputted.
[0027] Adder 6-k adds the transmitted power value pk in front of the 1 measurement cycle T outputted from amount of increase and decrease deltapk, and delay circuit 7-k, and outputs an addition result. An addition result is inputted into transmitting section 8-k as a new transmitted power value pk over a mobile station MSk. Moreover, an addition result is inputted also into delay circuit 7-k, and is used for count of the transmitted power value pk after a measurement cycle T. Transmitting section 8-k sets the transmitted power of the sending signal to a mobile station MSk as the transmitted power value pk.
[0028] According to this invention, when total of the transmitted power from a base station A to all mobile stations is large, amount of increase and decrease deltapk is updated so that total of the transmitted power may decrease. Moreover, amount of increase and decrease deltapk is more greatly set up to a mobile station with a more high priority. That is, it prevents the total transmitted power becoming large beyond the need by lowering the transmitted power to a mobile station with a low priority, the transceiver quality of a mobile station with a high priority holding.
[0029]
[Effect of the Invention] The following effectiveness is acquired about the transmitted power control unit of this invention as mentioned above.
[0030] When the total transmitted power of a base station becomes larger than a predetermined value, according to the magnitude of the difference, the transmitted power of the sending signal to a mobile station can be updated. Consequently, even when the number of mobile stations increases and interference power becomes large, the communication link quality of all mobile stations can prevent deteriorating uniformly. Furthermore, since it can prevent transmitted power increasing without limits, the effect of the interference power given to the wireless service area of an adjoining base station can be controlled.
[0031] Furthermore, quality degradation of an important communication link can be prevented, maintaining the total transmitted power of a base station below at the target total transmitted power, since transmitted power according to the priority of a mobile station can be updated. Moreover, the new service using the superiority or inferiority of quality etc. can be added to the contractor of mobile

communications.

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TECHNICAL FIELD

[Field of the Invention] Especially this invention relates to the going-down link transmitted power control unit in the migration communication system using a spread-spectrum communication mode about a transmitted power control unit.

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PRIOR ART

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[0003] The former in a CDMA method gets down and the link transmitted power control approach is as follows. The input-signal pair interference wave power ratio (it is called SIR below Signal-Interference Power Ratio:) required of an input signal is beforehand set to the interior of a mobile station as a target SIR. The value with small SIR means that the ratio to the interference wave power of a self signal is small, and the value with large SIR means that the ratio to the interference wave power of a self signal is large.
[0004] A mobile station observes SIR of an input signal and compares SIR and Target SIR which were observed. When observed SIR is smaller than Target SIR, a mobile station transmits the transmitted power control instruction which directs increase of transmitted power to a base station. When observed SIR is larger than Target SIR, a mobile station transmits the transmitted power control instruction which directs reduction of transmitted power to a base station. A base station adjusts the transmitted power of the sending signal to a corresponding mobile station according to this transmitted power control instruction.

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EFFECT OF THE INVENTION

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[0031] Furthermore, quality degradation of an important communication link can be prevented, maintaining the total transmitted power of a base station below at the target total transmitted power, since transmitted power according to the priority of a mobile station can be updated. Moreover, the new service using the superiority or inferiority of quality etc. can be added to the contractor of mobile communications.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] There are the following problems in the above-mentioned Prior art.
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[0007] Then, this invention aims at offering the transmitted power control unit which solved the above-mentioned problem.

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MEANS

[Means for Solving the Problem] In the transmitted power control unit which controls the power of the sending signal from a base station to two or more mobile stations by this invention for said every mobile station as a transmitted power control unit which attains the above-mentioned purpose according to the control signal from said each mobile station With the total transmitted power Observations Department which observes total of the power of said sending signal and outputs the total transmitted power value It has two or more transmitted power operation part which computes the new transmitted power value of the mobile station which corresponds using the multiplier operation part which computes the multiplier alpha according to said total transmitted power value, and said multiplier alpha and said control signal, and is outputted as a new transmitted power value, respectively. Said two or more transmitted power operation part is each. When said control signal shows reduction in power When the multiplication of -1 is carried out to the positive number used as the criteria of the amount of increase and decrease of transmitted power, a multiplication result is outputted and said control signal shows the increment in power The amount operation part of increase and decrease which subtracts the product of the priority multiplier defined according to the priority of a corresponding mobile station, and said multiplier alpha and said positive number from said positive number, and outputs a subtraction result, The adder which adds the transmitted power value in front of predetermined time, and the output of said amount operation part of increase and decrease, and outputs an addition result as said new transmitted power value, It has the delay circuit which only said predetermined time delays said new transmitted power value, and outputs it to said adder, and it offers the transmitted power control unit characterized by being a value more near 0, so that the communication link of the mobile station which is a larger value smaller than 1 than 0, and corresponds is more important for said priority multiplier.
[0009]
[Embodiment of the Invention] The transmitted power control unit of this invention is explained. A base station equipped with the transmitted power control unit of this invention is expressed as a base station A during explanation.
[0010] Drawing 1 is the block diagram of the transmitted power control unit of this invention.
[0011] The configuration of the transmitted power control unit of drawing 1 is explained.
[0012] A transmitted power control unit is equipped with the total transmitted power Observations Department 1, the multiplier operation part 2, the priority setting section 3, the transmitted power directions section 4, the amount operation part 5-1 of increase and decrease - 5-N, an adder 6-1 - 6-N, a delay circuit 7-1 - 7-N, and the transmitting section 8-1 - 8-N. N is the number of the mobile stations which the base station A connects concurrently. Amount operation part of increase and decrease 5-k, adder 6-k, delay circuit 7-k, and transmitting section 8-k (k= 1 - N) are used for control of the transmitted power used for transmission to the corresponding mobile station MSk.
[0013] The total transmitted power Observations Department 1 is a part in the wireless area of a base station A which observes total of the transmitted power to all mobile stations, and outputs observed value Pa. The multiplier operation part 2 is a part which computes the multiplier alpha used for the operation of the amount of increase and decrease of transmitted power according to observed value Pa.

The priority setting section 3 is a part which determines and outputs the weighting factor wi corresponding to the priority of each mobile station. It is a value with it. [from weighting factors w1-0] [large wN and] [smaller than 1] Weighting factors w1-wN are the values near 1, so that near and a priority are so low that the priority of the mobile stations MS1-MSk which correspond, respectively is high to 0. The transmitted power directions section 4 is a part which outputs each transmitted power control instruction transmitted from each mobile station as demand signs s1-sN to the corresponding amount operation part 5-1 of increase and decrease - 5-N. The demand sign sk shows the increment demand in transmitted power, when it is a forward value, and when it is a negative value, it shows a transmitted power reduction demand. Since each transmitted power control instruction is transmitted if needed for each mobile station, each transmitted power control instruction of all does not arrive at a base station A at coincidence.

[0014] The amount operation part 5-1 of increase and decrease - 5-N are circuits which calculate the amount of increase and decrease of the transmitted power to each mobile station using the weighting factors w1-wN which are the outputs of the priority setting section 3, a constant delta and the multiplier alpha which is the output of the multiplier operation part 2, and the demand signs s1-sN which are the outputs of the transmitted power directions section 4, only when the demand signs s1-sN are newly inputted. The amount operation part 5-1 of increase and decrease - 5-N output 0, when the demand signs s1-sN are not newly inputted. A constant delta is the amount of increase and decrease used as criteria.

[0015] A delay circuit 7-1 - 7-N are circuits which carry out 1 measurement-cycle T delay of the input value, and output it. An adder 6-1 - 6-N are parts which add the output of the amount operation part 5-1 of increase and decrease - 5-N, and the output of a delay circuit 7-1 - 7-N, and are outputted as transmitted power values p1-pN, respectively. In case the transmitting section 8-1 - 8-N transmit a signal to each mobile stations MS1-MSk, they adjust the transmitted power according to the corresponding transmitted power values p1-pN.

[0016] Actuation of the transmitted power control unit shown in drawing 1 is explained.

[0017] The total transmitted power Observations Department 1 observes the total transmitted power to all the mobile stations in the wireless area of a base station A. The total transmitted power Observations Department 1 measures the total transmitted power between the measurement cycles T of the signal outputted from the transmitting section 8-1 - 8-N, and outputs the average as observed value Pa to every measurement cycle T. Observed value Pa is inputted into the multiplier operation part 2.

[0018] The multiplier operation part 2 computes the multiplier alpha corresponding to observed value Pa. The approach of computing a multiplier alpha as an example of the calculation approach according to the graph of drawing 2 and the approach of computing a multiplier alpha according to the graph of drawing 3 are mentioned. By the approach of following the graph of drawing 2 , a multiplier alpha is decided in discontinuous corresponding to the range of observed value Pa. For example, when observed value Pa is larger than a value Th 2 and smaller than a value Th 3, alpha 2 is outputted as a multiplier alpha. By the approach of following the graph of drawing 3 , a multiplier alpha is continuously decided corresponding to observed value Pa. A multiplier alpha is set to 1 when observed value Pa is larger than the maximum total transmitted power value Pmax which may be applied to the communication link between a base station and a mobile station in any case. A multiplier alpha is inputted into the amount operation part 5-1 of increase and decrease corresponding to each mobile station - 5-N.

[0019] The priority setting section 3 sets up and outputs a weighting factor wk. The approach of a base station A determining the priority over each mobile station as an example of the setting approach, and deciding the weighting factor wk corresponding to the priority, and how a priority to require each mobile station is transmitted to a base station A, and a base station A determines a weighting factor wk according to the priority are mentioned.

[0020] A base station A explains how to determine the priority over a mobile station MSk and to decide the weighting factor wk corresponding to the priority.

[0021] The priority setting section 3 has a conversion table with the weighting factors w1-wk according to the contents of a contract of each mobile stations MS1-MSN and each mobile stations MS1-MSN in the interior beforehand. A conversion table is rewritten whenever each mobile station frequents the area

of a base station A. A mobile station MSk establishes a system synchronization by detection of the pilot channel from a base station A, and detection of a system channel, when it enters in the area of a base station A. Then, a mobile station MSk transmits registration (user information and terminal information) to a base station A. A base station A transmits the terminal information received from the mobile station MSk to a control station. A control station detects the contents of service which the terminal user has joined from the received terminal information, and transmits to a base station A. A base station A sets the weighting factor wk corresponding to a mobile station MSk as the conversion table of the priority setting section 3 interior according to the contents of service. For example, when the mobile station MSk is carrying out the service contract of thinking quality as important, in the conversion table of the priority setting section 3 interior, 0.3 is set up as a weighting factor wk corresponding to a mobile station MSk.

[0022] A setup of this weighting factor is performed at the time of the arrival of each mobile station, and dispatch. At the time of arrival of the mail, a base station A emits ringing of a mobile station MSk to area first. A mobile station MSk transmits a response message to a base station A. When a base station A receives a response message, the priority setting section 3 outputs the weighting factor wk of a mobile station MSk to amount operation part of increase and decrease 5-k. At the time of dispatch, a mobile station MSk outputs a message demand signal to a base station A first. When a base station A receives a message demand signal, the priority setting section 3 outputs the weighting factor wk of a mobile station MSk to amount operation part of increase and decrease 5-k.

[0023] How a priority to require each mobile station is transmitted to a base station A, and a base station A determines a weighting factor wk according to the priority is explained.

[0024] The flag showing a priority is inserted in the response message. A priority is expressed using ten figures to 1-10, and the more numerous one is more important for it. A base station A takes out a priority from the flag showing the priority in a response message, and sends it to the priority setting section 3. The priority setting section 3 calculates the inverse number of a priority, and outputs it to amount operation part of increase and decrease 5-k as a weighting factor wk.

[0025] The demand signs s1-sN are also inputted into each amount operation part 5-1 of increase and decrease - 5-N from the transmitted power directions section 4. Amount operation part of increase and decrease 5-k (k= 1 - N) calculates amount of increase and decrease deltapk of transmitted power to a mobile station MSk using a degree type, when the demand sign sk is newly inputted.

[0026]

[Equation 1]

sk> In the case of 0 In the case of delta pk=delta-wk-alpha-delta sk<0 Amount operation part of deltapk=-delta increase and decrease 5-k (k= 1 - N) outputs 0 as amount of increase and decrease deltapk, when the demand sign sk is not newly inputted.

[0027] Adder 6-k adds the transmitted power value pk in front of the 1 measurement cycle T outputted from amount of increase and decrease deltapk, and delay circuit 7-k, and outputs an addition result. An addition result is inputted into transmitting section 8-k as a new transmitted power value pk over a mobile station MSk. Moreover, an addition result is inputted also into delay circuit 7-k, and is used for count of the transmitted power value pk after a measurement cycle T. Transmitting section 8-k sets the transmitted power of the sending signal to a mobile station MSk as the transmitted power value pk.

[0028] According to this invention, when total of the transmitted power from a base station A to all mobile stations is large, amount of increase and decrease deltapk is updated so that total of the transmitted power may decrease. Moreover, amount of increase and decrease deltapk is more greatly set up to a mobile station with a more high priority. That is, it prevents the total transmitted power becoming large beyond the need by lowering the transmitted power to a mobile station with a low priority, the transceiver quality of a mobile station with a high priority holding.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of the transmitted power control unit of this invention.
[Drawing 2] It is the 1st related Fig. of observed value Pa and a multiplier alpha.
[Drawing 3] It is the 2nd related Fig. of observed value Pa and a multiplier alpha.
[Description of Notations]
1 -- The Total Transmitted Power Observations Department
2 -- Multiplier Operation Part
3 -- Priority Setting Section
4 -- Transmitted Power Directions Section
5-1 - 5-N -- The amount operation part of increase and decrease
6-1 - 6-N -- Adder
7-1 - 7-N -- Delay circuit
8-1 - 8-N -- Transmitting section

[Translation done.]

* NOTICES *

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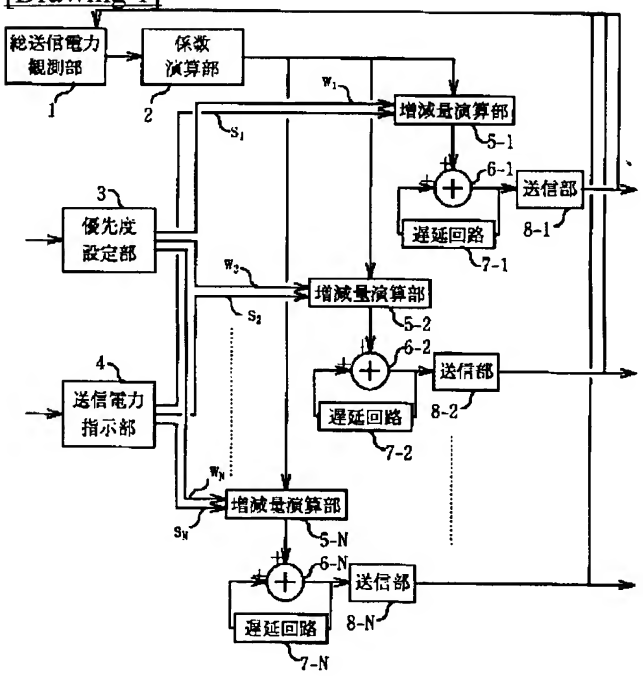
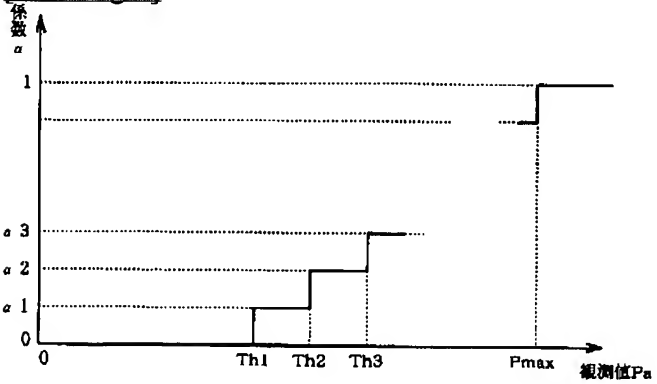
DRAWINGS

[Drawing 1]



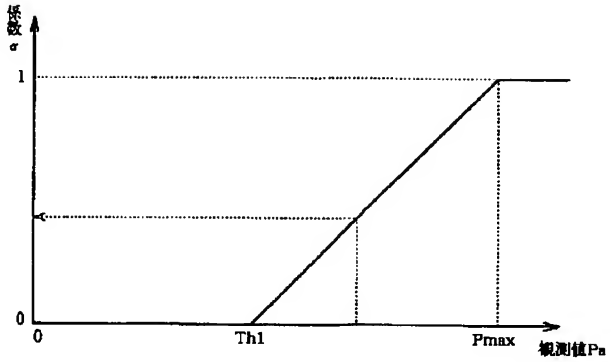
本発明の送信電力制御装置のブロック図

[Drawing 2]



[Drawing 3]

h c g cg b eb cg e e



[Translation done.]

h c g cg b eb cg e e